

BLEACH, FORMALDEHYDE AND EMBALMERS. THE FUNERAL INDUSTRY'S TOXIC LOVE TRIANGLE.

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In our current article we discuss and dissect the ridiculous toxic love triangle of embalmers and their formaldehyde and bleach. We review how the love affair started in the embalming industry and the unfortunate hazardous exposure consequences of mixing and excessive use of these toxic chemicals in embalming rooms. What really is bleach and why it is totally unsuitable for embalming use, the toxic gases bleach releases when used with formaldehyde and the dangers they pose, the care-less attitude of the funeral industry and the various associations, the exposure/disposal hazards of bleach and formaldehyde, limitations and outright failures of bleach in various disinfection scenarios (including HIV, TB, Poliovirus and CJD), and safer and saner, effective alternatives to bleach in all embalming situations. These topics and more will be covered in depth. Be aware, brutal honesty, my opinions and some sarcastic humor follows.

You smell that? Do you smell that? Bleach and formaldehyde — son! The toxic fumes of formaldehyde mixed with bleach! Nothing else smells like that! I love the smell of bleach and formaldehyde in the morning!

*Lt. Col. Bill Kilbalmer,
APOCALYPTIC undertaker/embalmer, exiting the prep room after another high exposure/high index formaldehyde embOMBing mission with a saturation bleaching.*

And a toxic love triangle it is, indeed. If it wasn't bad enough that most embalmers prefer high index/high exposure formaldehyde embalmings that yield rockhard and dehydrated bodies, the preferred disinfection and cleanup chemical is chlorine bleach, and lots of it. The combination exposures from these two nasty and toxic chemicals is totally needless in embalming and, really, their use and justification is just an urban myth in the embalming industry. I have published an extensive overview of the unnecessary and unsafe use of bleach in embalming rooms, especially when exposures are mixed with other chemicals, such as formaldehyde, in a previous Champion Expanding Encyclopedia article, and I encourage you to read it.

In that article, I debunk the overblown opinions of bleach in embalming and delineate the increased exposure hazards involved in throwing bleach into the chemical mix of formaldehyde saturated embalming rooms. That we are even discussing this problem, despite what we have known for some years now, is a sad commentary on an industry that chooses extinction through its refusal to change, rather than a future through innovation and adaptation. Safer, saner and more effective alternatives to both these chemicals exist, in almost all circumstances, and it is a great discredit to our industry that the overwhelming majority of embalmers refuse or ignore the realities of embalming chemical exposure, and choose to just do it — "quick, cheap and dirty, like we always have". With that said, let's delve into the whys and wherefores of bleach and formaldehyde in embalming.

In a nutshell, like the title of my previous article in the Champion Encyclopedia, bleach is overrated and overused in embalming. In fact, it's way overrated and way overused. Bleach is no magic bullet and never was. Documented failures are all over the page, including certain scenarios with HIV, TB, and Poliovirus Type3. Bleach dilutions of 1 : 10 have failed at long contact times of 5 minutes against HIV. Constant rewetting is required on surfaces, due to the 80% loss of chlorine, over one hour time frames, with resultant disinfection failures. 1% and 2% bleach solutions (activated and buffered) require up to 9: 1 v/v dilutions for blood spills and resistant organisms. Gross organic debris essentially neutralizes chlorine oxidation potential. Phenolics or NaDCC are as or more effective on blood spills, in most scenarios. Only undiluted or 1: 1 bleach dilutions works on TB suspension tests and Poliovirus Type3 scenarios that achieve $>\log_3$ reductions of infectious organisms. In fact, most use, worldwide, of bleach is as an industrial bleacher/whitener and as a pesticide, not as a disinfectant.

It doesn't qualify as anywhere near perfect with CJD, BSE or Scrapie either. Yes, it generally works, but not always. 5% solutions are no longer thought perfect for CJD/Scrapie scenarios. 2.5% solutions are only partial and even at 60 minutes contact time. 20,000 PPM chlorine appears effective at 30 minutes, but only with rewetting. 6.25% chlorine appears effective at 45 minutes, but was only tested on 1 strain. 12.5% appeared to work at 30 minutes, but only tested against one strain. 8.25% solutions have been tested at 30 minutes, but only for 2 BSE strains and not tested against CJD/Scrapie. Bottom line, in virtually all scenarios, 1N NaOH or 2N NaOH alternative solutions were equal or better in efficacy to chlorine solutions. To top it all off, the funeral industry has always misunderstood the 1987 CDC recommendations for alternative AIDS disinfection and didn't take note of the 1995 revisions that clarified their stance. I don't even want to recall the number of times some misguided and uninformed embalmers have told me how they injected bleach into AIDS bodies to supposedly disinfect them. Consequently, in the funeral industry, bleach is mythologized as the end all and the be all of embalming room disinfection. Nothing is farther from the truth.

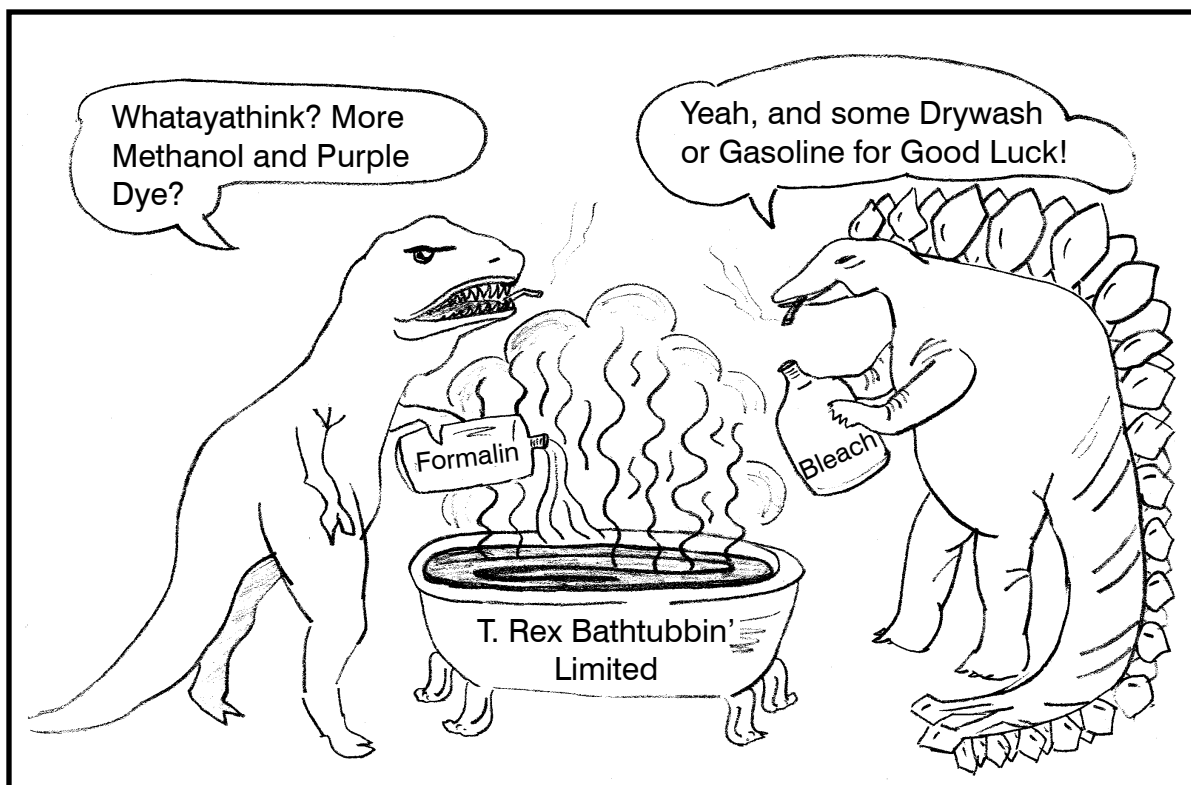
Most embalmers don't even understand what bleach really is. Most assume it is a super cheap and ready-to-go bang-up disinfectant right out of the jug. They are very, very wrong. Bleach is nothing more than a dilute, very dilute, solution of sodium hypochlorite in water. 94%-97% of the bottle is just water and the hypochlorite only 3-6% typically. The hypochlorite is not even the actual disinfecting species, that being hypochlorous acid. The problem with bleach is that due to its typical pH, which is usually through the ceiling at pH 9-11, a vanishingly small amount of hypochlorous acid is available for actual disinfection. Consequently, you need all the bleach you can get and in full strength for any serious disinfection purpose. This is the reason why many other chlorine products are available instead of consumer bleach, which is designed for just that, bleaching and whitening your laundry. Industrial bleaches are 10-12% solutions and HTH CaOCL is a 60-70% active Hi-Test Calcium hypochlorite powder, which really packs a wallop. Also available is NaDCC, Sodium Dichloroisocyanurate which evolves 35-50% active chlorine and sees use in swimming pools and spas. Chlorine disinfection of swimming pools is very effective due to the close control of the pH, making certain it remains in a narrow non-basic titration range.

All of the testing and statistics regarding bleach and disinfection is done with freshly made and acid-titrated samples made immediately prior to testing and not that bottle of bleach that you bought from the grocery store 3 to 6 months ago. That grocery store bleach you have in the embalming room has practically no hypochlorous acid in solution and is seriously degraded and far too high on the pH scale to be a reliable and effective disinfectant in action. If you can accurately control and determine the pH and resultant titres of hypochlorous acid in bleach solutions, then you have a very effective and broad-spectrum disinfectant, if not, then all you have is what you have, a bottle of cheap supermarket bleach.

Bleach is a pretty nasty and toxic chemical in its own right, let alone when you mix it inadvertently or on purpose with formaldehyde and some other chemicals that appear in embalming rooms. It's a cardiovascular/blood toxicant, neurotoxicant and skin/sense organ toxicant. It appears on 2 Federal Regulatory Lists and is more dangerous than most chemicals in 1 out of 3 ranking systems. Bleach is, by nature, caustic, corrosive, and evolves CL2 (chlorine) gas in most scenarios. Inhalation causes burning and labored breathing, skin contact generates burns, pain and severe blistering, eye contact results in serious burns and permanent eye damage and ingestion causes burns, shock, vomiting and unconsciousness. Things get even worse when you mix bleach with formaldehyde. Mixing with formaldehyde results in the evolution of chlorine gas, fomic acid, hydrochloric acid fumes, chlorine oxides and possibly other hazardous by-products of chemical interaction, such as BCME (bis-chloromethyl ether), a very dangerous, neurotoxic gas. In other words, a very toxic witches brew of many hazardous chemicals is generated by the use of bleach and formaldehyde in embalming rooms, and, sadly, it is completely needless.

Bleach is not compatible with phenol and other phenolics, that are found in embalming rooms, and exothermic gas-generating reactions are possible. Bleach is also not compatible with ammonia-based cleaners and quat-based disinfectants used in embalming rooms. Hydrochloric acid, hydrazine, chloramines, ammonia gas and oxygen free-radical species (from chloramine interaction with lung tissue) are all generated when bleach and ammonia-based cleaners, soaps, sanitizers, detergents and disinfectants are mixed in embalming rooms. Bleach requires its own MSDS and protocol for safe use, storage and spill cleanup. It is highly corrosive to most surfaces, instruments, embalming equipment and degrades rubber and plastic goods used in embalming rooms. Everybody knows not to clean their toilet with an ammonia cleaner and then disinfect and brighten it with a chlorine bleach chemical, but apparently that message gets lost in the formaldehyde haze of the embalming room. In fact, it's so bad that some of the how-to embalming articles that you can find actually talk about what scent of bleach is best for embalming room use — "lemon fresh" or "spring bouquet"! This is seriously and profoundly being misguided and misinformed.

THE REAL REASON THE DINOSAURS BECAME EXTINCT



Embalmosaurus Obsoletus busily plying their trade.

The corrosive and caustic effect of chlorine bleach is well known, but not talked about in the funeral industry. The various Associations and the embalming industry, in general, wants to pretend that it really doesn't exist or is of little concern. Consequently, alternatives to bleach, such as sodium hydroxide, are vigorously attacked and warned against, but little, if anything, is ever said regarding pouring bleach down the drain, let alone mixing it with formaldehyde. Apparently, because it is perceived as a CJD magic bullet and so cheap and convenient, all that corrosivity can just be overlooked. This is not how I see it. Chlorine bleach has a pH through the roof and is classified on whatever regulatory scale that you want to use as a caustic and corrosive chemical in use. And if that wasn't bad enough, there is no good way to neutralize chlorine bleach in embalming rooms before it goes down the drain. Such, however, is not the case with 1N or 2N NaOH (sodium hydroxide) solutions which can easily be neutralized by addition of acetic acid, which is nothing more than plain household vinegar. This simple procedure renders NaOH solutions neutralized to essential neutrality and then capable of being easily disposed of down the embalming room drain.

This neutralization would be impossible to do with bleach under any circumstances. Sodium hydroxide and chlorine bleach are both caustic and safety precautions must be taken with both chemicals. But, if a corrosive or caustic is required for special circumstances such as CJD cases in embalming, then sodium hydroxide is obviously the preferred choice in embalming rooms, as the most manageable, less reactive and most capable of neutralization. This is exactly the opposite of that which is professed by the embalming industry, the Associations and various and sundry spokespersons for embalmers. In my opinion, this stance ignores the brutal truths and realities of bleach in formaldehyde embalming rooms, is flat out wrong and does a great disservice to the embalming industry by perpetuating this misconception.

The solution? — you simply don't have to use bleach in embalming rooms, ever. There is absolutely nothing that chlorine bleach solutions are capable of doing in embalming rooms that safer, saner and more effective alternative disinfectants do not do better. Superior and very safe quat-based disinfectants (Maxima 128), phenolic-based medium-level disinfectants (Bruphene), highly effective surface sprays such as Metriguard, and, of course, glutaraldehyde-based high level disinfectant/sterilants (such as Metricide) for embalming instruments, are all readily available and render bleach obsolete in all circumstances. For CJD cases, NaOH solutions are as or more effective and more manageable. The Champion Company has always actively encouraged our customers to utilize these much preferred and effective disinfectants for all usage in the embalming room and avoid bleach in all embalming situations. All of these alternative disinfectants outperform and outclass bleach on all parameters of safety and effectiveness in embalming operations.

And while you're at it, why don't you eliminate 90% of the formaldehyde you use in embalming? Formaldehyde is a toxic cancer-causing gas that causes more trouble in embalming than it solves. Safer and very effective alternatives, such as glutaraldehyde, are readily available in many embalming formulations and yield excellent results.

So why is so much bleach being used in embalming rooms, despite the massive indictment against it and the ready availability of superior alternatives? Oh, I think you know the answer. It's cheap, it's easy, it's quick, we've always used it, nobody I know ever dropped dead from using bleach and formaldehyde, it's cheap, everybody says it's the only thing that works with CJD, it makes the embalming room smell better, if it works on AIDS - it's good enough for me, it's cheap, it's what they use on the cruise ships isn't it, we have to do the prep room laundry anyway, and I really don't care — and did I mention that's it's really cheap? I think you get the point here. I hope I have convinced you that bleach doesn't need to be in embalming rooms, ever. There are just too many safer, saner and more effective

disinfectants out there that are available for our use. Need to do some serious stain-removal and whitening with your laundry? — then I agree, grab the bleach — just keep it out of the embalming room.

Still happy with your bleach, always used it, always will, don't care what the facts are, don't care what I think? — then, I wish you the best of luck, I really do, I think you'll need it. Remember, every breath you take in the embalming room is yours — forever. On a final note, as always, embalm smart, embalm safe.

REFERENCES AND ADDENDA: For an extensive overview of bleach and formaldehyde in embalming, consult my earlier Champion Encyclopedia on Bleach that is available on our website www.champion-newera.com.

A note regarding BCME: My statements in my original Champion Encyclopedia article were called to task as unfounded and undocumented. After extensive researching of the literature, I am convinced that BCME is possible in this scenario, at least in trace amounts, and the situation loosely mimics a successful lab synthesis. The small or trace quantities of BCME that may be generated is not the significant problem here, all the other noxious gases that are generated in very definite quantities when bleach and formaldehyde interact, however, are. That all these reaction gases are even possible and we are even having this discussion about probable toxic reaction products, just exemplifies the total absurdity of the situation regarding the commonplace and indiscriminate usage of formaldehyde and bleach in embalming rooms.

A note concerning NaOH and formaldehyde: There have been reports, particularly in closed systems, of possible hydrogen gas evolution when formaldehyde and NaOH react in certain concentrations. Formaldehyde, having no alpha-hydrogens, reacts in a normally expected Cannizzaro reaction, but some hydrogen gas, a possible explosion hazard in closed-systems, is also detected. In embalming room scenarios that are well-ventilated and open-spaced, this is probably not a serious concern, due to the dilutions and quantities of reactants present. I would still always choose NaOH over chlorine bleach, in any embalming scenario. The generalized and untoward hyperreactivity of formaldehyde in embalming with production of toxic and noxious byproducts, again, rears its ugly head. Bleach is definitely bad news with formaldehyde and NaOH possibly has a reaction problem also. Is it just me, or does formaldehyde always seem to be bad news? Well, that's for you to decide.

One additional comment: In the embalming industry's constant quest for cheap consumer use products to replace professional chemical and embalming products, some embalmers have approached me with the idea of non-chlorine or color-safe bleach as another good low-cost alternative to plain chlorine bleach. This is a bad idea — these bleaches are peroxide-based and a vigorous exothermic, gas-evolving reaction is possible with formaldehyde. It's great for the laundry, keep it there — right next to the chlorine bleach, where they both belong — not in the embalming room. And finally, thanks to Pam and Gabrielle for the great artwork.